



Meridian Energy

Manapouri

The journey of water

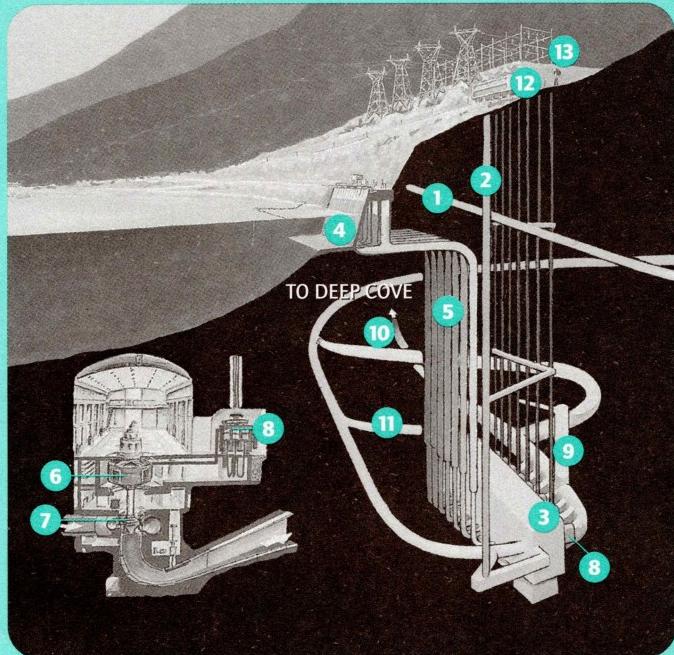
DECEMBER 2005 PART OF A SERIES OF MERIDIAN ENERGY'S INFORMATION RESOURCES



Location



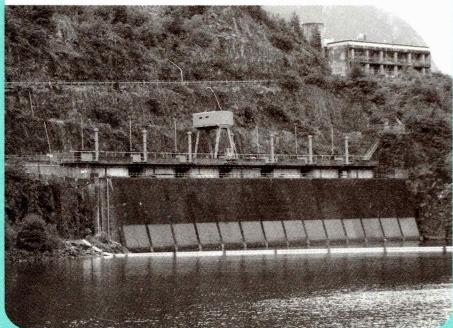
Inner workings



1. Underground access tunnel, 2km long.
2. Lift shaft, 193m deep.
3. Machine hall.
4. Intakes and screens, 7 water intakes protected by screens.
5. Penstocks, carry water to turbines, 180m long.
6. Generators, produce 107MVA.
7. Turbines, produce 144,000hp.
8. Transformer vaults, 7 transformers step voltage up from 13.8kV to 220kV, 135 MVA.
9. Surge shaft to allow for changes in generation load.
10. First tailrace tunnel, a 9.2m diameter concrete-lined horseshoe section tunnel.
11. Emergency exit, an alternative exit from the machine hall to the access tunnel.
12. Control building, housing communications, generation and the administration centre.
13. 220kV switchyard, location of the switch gear between generation and transmission.

The journey of water

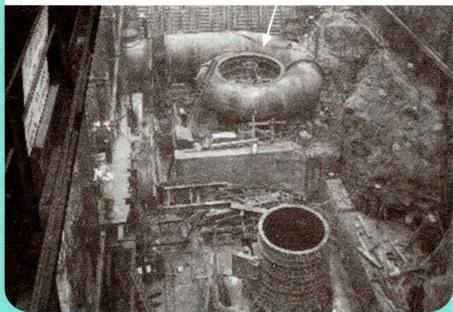
Water enters the power station at the intake screens...



...travels 180m down the 3.5m wide penstocks...



...and continues around the scroll case.



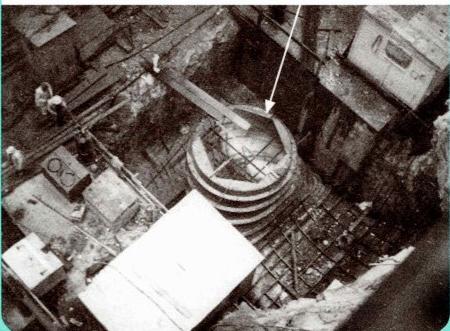
The wicket gates then regulate how much water flows through (these open and close as required)...



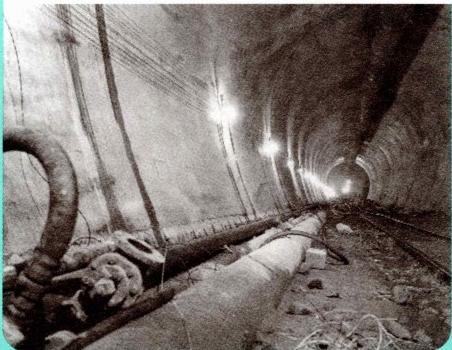
...to push the turbine around.



From the turbine, the water then drops through the draft tube into the manifold



... and out the tailrace tunnels...



...to Deep Cove.



Creating electricity

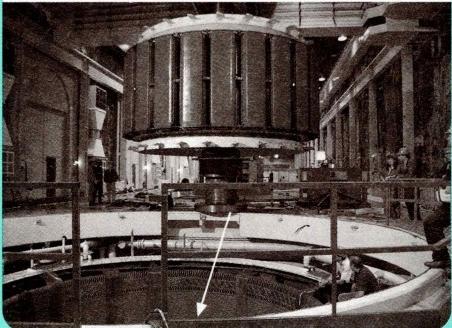
The turbine...



...is connected to the generator above by the turbine shaft.



The shaft is connected to the rotor which spins inside the stator.



The rotor spins at 250 revolutions per minute.



It is the reaction of magnetic fields around the outside of the rotor sweeping through the windings on the inside of the stator that creates the electricity.

Creating electricity - continued

The exciter is used to stimulate and control the generator.



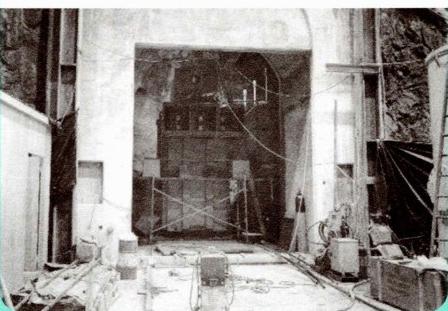
The electricity runs from the generator at 13,800 volts (13.8 kV) through the 'isolated phase bus' and up to...



...the transformers.



The transformer boosts the voltage of the electricity from 13,800 volts (13.8 kV) to 220,000 volts (220 kV).



Three cables from each transformer then travel 263m vertically up the cable shafts to...

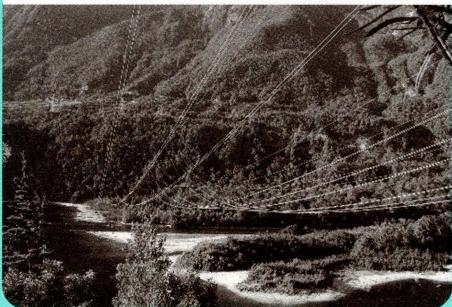


...the switchyard.

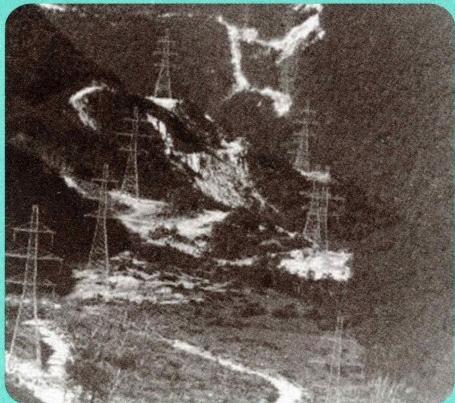
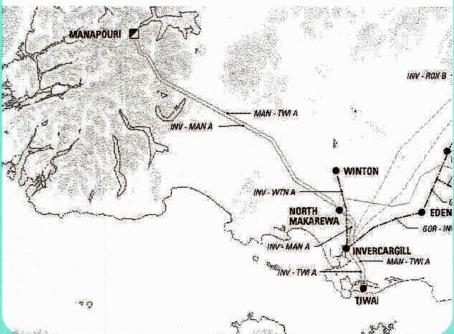


Creating electricity – continued

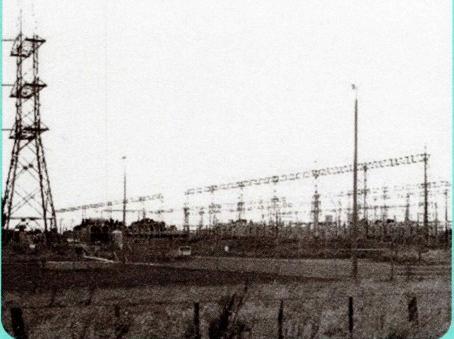
From the switchyard the power lines travel across Lake Manapouri. This is the longest span of power lines in New Zealand (1.18km).



The power lines then travel 167km over and through the Southland countryside...



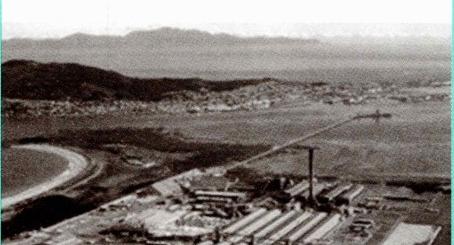
...to substations at Makarewa



and Invercargill, with the majority of the power carrying on to...



...the Tiwai Aluminium Smelter.



This smelter is located across the harbour from the township of Bluff at the bottom of the South Island of New Zealand.

Tunnelling methods

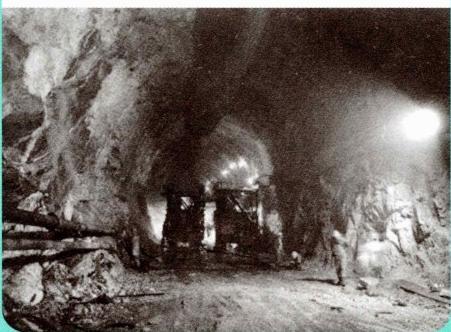
The original construction was completed by drilling holes to pack with explosives and blasting away the rock.



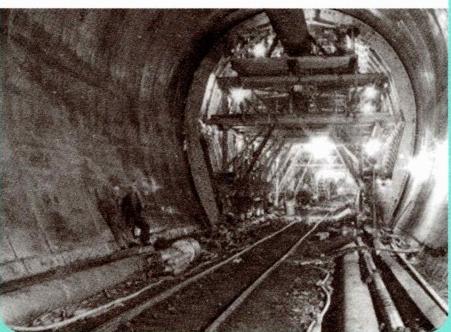
The rock was removed from the construction area by trucks and, in the first tailrace tunnel, by train wagons.



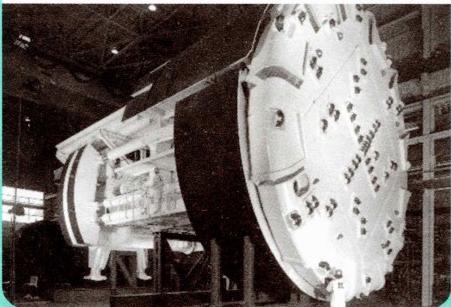
Blasting left a rough surface.



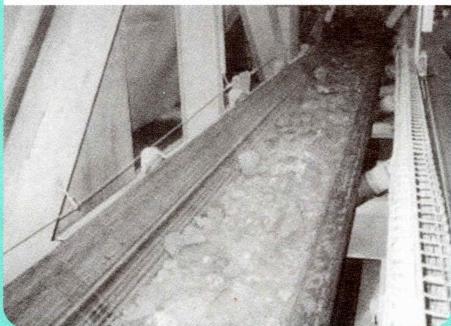
In the first tailrace tunnel, this needed to be fully lined.



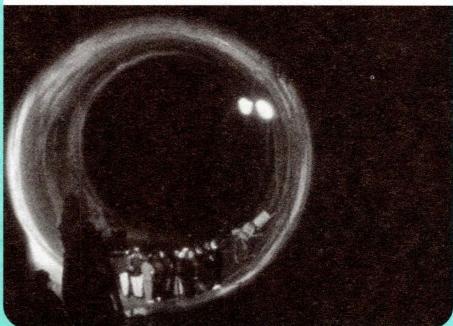
The second tailrace tunnel, which was completed May 2002, was constructed by using a Tunnel Boring Machine (TBM).



This TBM had its own conveyer belt to remove the debris...



...and left a very smooth surface.

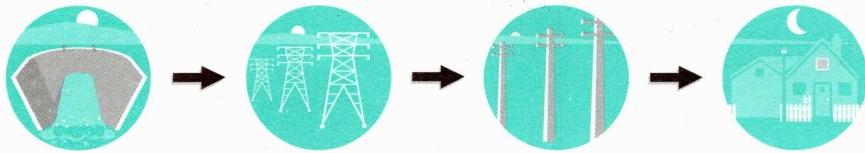


Electricity production in New Zealand

There are several companies that generate electricity throughout New Zealand, including Meridian Energy. This electricity is delivered to the central transmission system (the National Grid), which is managed by Transpower. Electricity is then distributed to regional

lines companies who manage the local lines that deliver electricity to your home. Homes, businesses, factories, farms, shops and schools buy the electricity they use from retail electricity companies.

Power Distribution



Generator

Transmission

Local Lines

You

Find out more about Meridian Energy.

Take a look at all the fact sheets in this series:

Waitaki Hydro Scheme

Tekapo A Power Station • Tekapo B Power Station • Ohau A Power Station • Ohau B and Ohau C Power Stations
Benmore Power Station • Aviemore Power Station • Waitaki Power Station • Waitaki - Working with the Environment

Manapouri Hydro Scheme

Manapouri Power Station • Manapouri - The Second Tailrace Tunnel • Manapouri - Working with the Environment
Introducing Meridian Energy • Energy efficiency brochures - residential and business

You can download pdf copies from our website at www.meridianenergy.co.nz

If you'd like to know more about Meridian Energy, call us on 0800 496 496, between 7.30am and 7.30pm, Monday to Friday, excluding public holidays.

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